

P-7.

May 1, 1914.

GENERAL SPECIFICATIONS FOR MACHINERY.

BUREAU OF STEAM ENGINEERING, NAVY DEPARTMENT.

P-7. CLOTHING AND LAGGING.

For Painting, see M-2.

P-7-a. General.

1. All clothing on boilers, steam pipes, and cylinders must be incombustible and durable.
2. Samples of all nonconducting material, the character of which is not clearly specified, must be submitted for approval of the Bureau, with the recommendations of the Inspector of Machinery.
3. Care is to be taken that all parts required by the specifications are thoroughly clothed and that all clothing is properly protected by approved lagging from wear, displacement, or other causes for deterioration, and that the ends of the clothing are properly closed.
4. Provision for removability is to be made in all cases where needed and joints are to be made accessible.
5. The specifications are drawn to secure the most efficient clothing and lagging that can be applied, and it is the desire of the Bureau to have all surfaces clothed and lagged wherever it is advisable to do so.
6. Nonconducting material will consist of one of the following or other approved materials, unless otherwise specified:
Magnesia as specified in section P-7-d.
Diatomaceous covering equal to that tested at the Naval Engineering Experiment Station, Annapolis, Md., 1914. *(Exp Sta Test 389)*
7. Where oil heaters are close to the boilers, the piping from the heaters to the atomizers will not be lagged.

P-7-b. Table of requirements.

1. There will be clothing and lagging on pipes, boilers, and machinery as follows:

Machinery.	Clothing.	Lagging.
Main engine cylinders and valve chests, after being finally secured in the vessel and tested.	Approved nonconducting material.....	Neatly lagged all over with galvanized sheet iron or steel 28 mils thick.
Upper cylinder heads and valve chest covers of main engines.do.....	Neatly fitting floor plates or cast iron plates with flat-topped or diamond-checked corrugations.
Turbine casings and steam chests after being finally secured in place in the vessel and tested. The lower half of turbine casings may be clothed and lagged before being placed on the vessel, but must be so fitted that all steam joints can be uncovered and made accessible.	Approved nonconducting material, as follows: H. P. part of turbines, 3 inches thick; I. P. part of turbines, 2 inches thick; L. P. part of turbines, 1 inch thick. NOTE.—The exact thickness on different parts depending on type and design of turbine.	Neatly lagged all over with galvanized sheet iron or steel, top quarter 38 mils thick; balance 28 mils thick.
Steam cylinders of all auxiliary engines and casings of all auxiliary turbines.	Approved nonconducting material, 1 1/4 inches thick. Cylinders below 5 inches diameter the thickness will be same as pipe. Lagging hoods easily removable will be fitted on steam cylinders of all auxiliary engines 5 inches in diameter and above.	Galvanized sheet iron or steel 28 mils thick.
Main, steam pipes and valves in engine rooms, pipes adjacent to passageways, pipes exposed to great heat, and pipes where covering is liable to be chafed.	In an approved manner, with sectional approved nonconducting material. When near magazines, steam and exhaust pipes will have a double thickness. Main steam pipe clothing double standard thickness for its entire length.	Galvanized sheet iron or steel 14 mils thick.
All other steam and exhaust pipes and valves, and all feed discharge pipes and valves.do.....	Canvas sewed on and well painted.
All pipes of refrigerating plant outside of refrigerating rooms.	Cork of standard thickness for brine piping.	Do.

P-7-b. Table of requirements—Continued.

Machinery.	Clothing.	Lagging.
Auxiliary condensers, evaporators, feed-water heaters, oil-fuel heaters, separators, etc., as may be required.	Approved nonconducting material, $1\frac{1}{2}$ inches thick.	Galvanized sheet iron or steel 14 mils thick.
Oil coolers.....	Hair felt or other approved material, $\frac{1}{2}$ inch thick.	Do.
Water pipes, except feed pipes, above floors.	Hair felt 1 inch thick for hot water, $\frac{1}{2}$ inch thick for cold water.	Canvas sewed on and well painted.
Heating pipes from auxiliary steam pipes to radiators or coils, and from radiators or coils to traps.	Approved nonconducting material.....	Do.
Heating pipes, when in storerooms or compartments used for perishable stores.	Approved nonconducting material, double standard thickness.	Do.
Boiler drums, other exposed parts of boilers if required.	Approved nonconducting material.....	Galvanized sheet iron or steel 31 mils thick.
Other pipes and machinery as may be directed.	As directed.....	As directed.

P-7-c. Details.

1. Main exhaust from L. P. turbines, exhaust from dynamo turbines, main condensers for turbines, and dynamo condensers will not be lagged.

2. The standard thickness of pipe covering will be as follows:

	Inches thick.
For pipes $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches, inclusive.....	$\frac{3}{8}$
For pipes 2 inches to $3\frac{1}{2}$ inches, inclusive.....	$1\frac{1}{2}$
For pipes 4 inches to 6 inches, inclusive.....	$1\frac{1}{2}$
For pipes 7 inches to 10 inches, inclusive.....	$1\frac{1}{2}$
For pipes over 10 inches.....	$1\frac{1}{2}$

3. Wherever sectional block covering is used it will be secured in place by 1-inch mesh No. 18 gauge galvanized wire netting with No. 18 gauge black annealed lacing wire before being lagged.

4. Flanges of pipes above 5 inches diameter will, when practicable, be covered with plastic magnesia or other approved nonconducting material $1\frac{1}{2}$ inches thick, and lagged with canvas in such a manner that clothing may be easily removed without injury. Where flanges are not clothed, the clothing on pipe will be extended to as near the flanges as practicable and will be completely covered by the lagging.

5. Oil coolers and water pipes and other parts liable to hold cold water will have waterproof paper next to plates and pipes under covering.

6. Lagging will be made removable over all manhole covers, etc., and elsewhere will be so secured as to be easily removed, replaced, and repaired, and all pieces will be plainly marked to show where they belong.

7. All canvas lagging will be of approved quality and in accordance with the Navy Department leaflet specifications for cotton canvas.

Canvas covering will be as follows:	Weight per square yard.
	Ounces.
Pipes 5 inches diameter and below.....	10
Pipes above 5 inches diameter, separators, feed heaters, etc.	15

8. All metal lagging, except on boilers, will be secured with polished brass bands and roundheaded brass screws.

9. Where clothing is lagged with metal, canvas will be omitted and the clothing secured as described in paragraph 3 above.

P-7-d. Magnesia.

1. Magnesia used for clothing and on uptakes, smoke pipes, etc., will be composed as follows:

Carbonate of magnesia, not less than 85 per cent.

Asbestos fiber, not less than 10 per cent.

Impurities or foreign matter, not more than 5 per cent.

(c) Blades inserted into grooves of dovetail or equivalent section, with space blocks integral with root of blades.

(d) Blade root cut to fit projection turned on circumference of the bucket wheel. Space blocks integral with blades.

3. In general, impulse blading will be machined at the tips to take the shrouding, which will be in short sections to eliminate expansion troubles, and be riveted on or secured in an approved substantial manner to the blades. Space between sections to be sufficient to allow expansion without ends of sections coming in contact.

4. The ends of the blades in reaction turbines will be turned to the required length to give the necessary clearance and will be decreased in thickness to prevent injury in case they should come in contact with the rotor or turbine casing.

5. Unless otherwise approved, all reaction blading $\frac{1}{2}$ inch long and over will be fitted with one or more rows of binding strips, the number dependent upon the lengths of blades. The binding strips will be soldered to the blades with silver solder.

6. Blade stops of approved type will be fitted as required in reaction turbines.

7. Blading for turbines will be named to suit the Bureau of Steam Engineering standard designation for right and left hand blades, as follows:

Looking at a blade with the convex side towards the observer and the roof of the blade down, the steam or inlet angle is on the right-hand blade and vice versa.

E-1-l. Dummies.

Materials.

Cylinder dummy rings, class C cast steel, when separate from cylinder.

Dummy strips, composition N-r, *Change 15* ~~aluminum~~ of composition 71 to 74 per cent copper, lead not to exceed 0.2 per cent, remainder zinc.

Rotor dummy rings, class B forged steel, when separate from rotor.

1. Dummy packing of either the contact or radial type will be provided as required.

2. Strips will be firmly secured to dummy rings, which will be separate from or integral with the rotors and casings approved.

E-1-j. Fittings.

1. Turbines will be provided with drain valves, pressure gauges, clearance gauges, and relief valves.

2. Where relief valves on turbines are so fitted as to discharge back into a lower stage there will be a sentinel whistle fitted in order to give audible warning when internal pressure approaches working limit.

3. The clearance gauges will be of micrometer type and be so fitted that the axial clearance of dummies or blades can be accurately determined.

4. Approved governors will be provided for the turbines. Overspeed governors will be adjusted to trip out at between 10 and 15 per cent above the rated maximum speed.

E-1-k. Drains.

1. All turbines will be fitted with drain pipes and valves where necessary. Particular care will be taken to drain all pockets within the turbine casing so as to leave the entire casing free from water when the turbines are not in use.

2. Turbine drain-valve handwheels will project through the floor above the valves and be operated in as convenient a manner as possible from the working platform. Indexes will be fitted showing clearly, from the working platform, the position of the valve whether open or closed.

3. Unless the condenser is located beneath the turbine so that the turbine will drain to it by gravity, the drains will be connected to an air pump. On ships fitted with main air pumps the drains will be led, through a water seal, to the main air pump suction; the main air pump will be located as low as possible, and there must be at least 24 inches between the lowest part of the blading and the main air pump foot valves. On other ships small air pumps will be provided for draining the turbines; the drains will lead through a water seal to the pump, which will be located as low as possible and at least 24 inches below the turbine; the pump discharge will be led to the main condenser and also to the main feed tank.

E-1-l. Lagging.

1. Lagging and clothing will conform to the requirements of section P-7. It will be so installed as to permit ready renewal, and also to permit of breaking all casing and steam-chest joints without disturbing the main body of the lagging.

All lifting eyes must project beyond outer surface of lagging, and lagging shall be applied in such manner that it will not be damaged by removing bolts from flanges or bosses, etc.